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MODIFICATION OF MURRAY AND TREGURTHA MODEL 02D PROPULSION UNIT

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Type B

by

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ABSTRACT

A new Murray and Tregurtha Model 02D Propulsion Unit was removed from stock and modified by installing hydraulic elevation and steering, strengthening the swing joint gear group, and providing a two-way oil pressure system for the tail section.

A 20-hour test in Port Hueneme Harbor indicated that the modified components should operate satisfactorily.

The unit is to be sent to an Amphibious Construction Battalion for in-service tests.

INTRODUCTION

The standard barge propulsion unit in use by the Amphibious Construction Battalions is the Murray and Tregurtha Model 06DH which has hydraulic tail section elevation and steering. For use on warping tugs operating in the surf, power elevation is necessary in order to raise the tail section quickly enough to prevent damage, if grounding or collision with a submerged object is imminent.

The Murray and Tregurtha Model 02D propulsion unit, developed and built during World War II, is not suitable for warping tug use as its tail section must be elevated manually, which is too slow to prevent damage in surf operations. The Navy has approximately 200 of these 02D units in stock. If a means could be found to adapt these units to warping tug use at reasonable cost, they could possibly replace the 06DH units for training purposes. This would serve the dual purpose of utilizing the old units and of saving the expensive modern units in stock for use in the event of a national emergency.

DISCUSSION OF MODIFICATIONS

A contract (No. NBy 32218) was made with Western Gear Corporation of Los Angeles to perform the following modifications to a M&T Model 02D propulsion unit taken from stock at Port Hueneme.

The 02D upper right angle drive section, known as the swing joint, is composed of truck differential parts which were used as an expedient during the war. Experience has indicated that a large number of failures have occurred in this joint as a result of cumulative deflections caused by shocks transmitted from the propeller as it bumps obstructions, even though none of these minor contacts alone would be sufficient to cause damage. To strengthen the system the 5-piece ring gear carrier was replaced by a rigid one-piece unit. (Figure 1)

Another probable source of trouble in the swing joint is the lack of a means of adjusting clearance between the ring gears and their pinions. As the ring gears are riveted to the gear carrier this spacing is fixed. A new set of gears was installed. The new ring gears were

bolted to the one-piece carrier and allowance made for shimming so the spacing could be adjusted for best performance. These new gears are heavier than the original ones and slightly smaller in diameter to accommodate more rugged pinion gears.

The existing tail section oil pump operates only in forward gear so reverse operation of the propeller is limited to a maximum of about two minutes at any one time. A two-way system was installed to provide oil pressure to the swing joint gears at all times in both forward and reverse gear operations.

The elevating worm and gear on the stock 02D unit were designed for manual operation which is extremely slow. Previous NCEL experience with power elevation (Reference 1) has shown that this gear system will not transmit the power required to elevate the tail section at speeds provided by power elevation. A new worm and gear set, designed for high speed operation, was installed.

A new interlocking main drive housing seal assembly in the swing joint provides resistance to any tendency toward separation of the joint caused by the torque between pinion and ring gears.

To provide hydraulic operation, a belt driven pump, steering and elevating hydraulic motors, and related equipment were installed. At the operators station, levers were installed just below the control panel to operate the hydraulic elevation and steering. A hydraulic pressure gage was placed just above the control panel. (Figure 2) The steering wheel was modified so it can be engaged for manual steering in case of hydraulic system failure and disengaged so it will not spin as the unit is steered hydraulically.

DESCRIPTION AND RESULTS OF TESTS

The propeller and propeller speed of the unit were not changed so the thrust and speed on any given barge are the same as those of the stock units. Therefore, the purpose of these tests was merely to determine the operating characteristics of the new and modified components.

Upon completion of the contract work an acceptance test was performed at the Western Gear Corporation plant in Los Angeles. The unit was set up on beams across a test pool and operated with the propeller in water.

After routine preliminary checks and warmup, the engine was run at idle in both forward and reverse gears and checked for oil pressure, generator output, water circulation and gear noise. This was repeated at engine speeds of 1000 and 1400 rpm. (At engine speeds above 1400 rpm the propeller pushed a wave of water over the edge of the pool so no tests were run above this speed.) No gear noise was discernible and all systems operated satisfactorily.

Power steering was checked at engine idle and at 1000 and 1400 rpm for proper operation and to ascertain that the propeller direction turned as indicated on the control lever plate. Power steering was disconnected and the manual steering was tried with the propeller turning at the same engine speeds as above. Both steering systems operated satisfactorily.

The tail section was elevated against propeller thrust at engine idle, 1000 and 1400 rpm and performed satisfactorily. With propeller not turning, the time to elevate the tail section 180 degrees was recorded. Specified time was a maximum of 60 seconds. Times recorded were:

1100 rpm	50 sec
1400 rpm	38 sec

After the above tests the unit was operated at 1400 engine rpm for an hour after which the swing joint gear housings were checked. No evidence of overheating was found.

At Port Hueneme the unit was mounted on a 3 x 15 pontoon barge and operated in the harbor both while tied to a dock and when under way. The tests performed at the Western Gear Corporation plant were repeated at the same engine speeds plus full throttle tests at 1700 rpm.

Times required to steer the tail section through 360 degrees using power steering, propeller not turning, were:

Engine RPM	to Port	to Starboard
1100	9 sec	9 sec
1400	7 sec	7 sec
1700	5 sec	5 sec

Time to elevate tail section 180 degrees, propeller not turning:

Engine RPM	Time
1100	50 sec
1400	38 sec
1700	27 sec

All of above timed tests were repeated three times at each speed and the same results were obtained each time.

The unit was operated for 20 hours in the harbor including above tests. It was maneuvered in such a manner that the hydraulic steering was used almost continuously and the tail section was frequently elevated approximately 30 degrees against propeller thrust. It was also operated frequently in reverse gear and the oil pressure from the two-way oil system was satisfactory at all times.

No trouble or evidence of gear overheating was encountered.

FUTURE PLANS

The unit will be shipped to an Amphibious Construction Battalion for in-service tests. It will be requested that it be used on a warping tug to determine if it can replace the Model 06DH unit in this type of work for training purposes.

After a year of in-service tests a final report will be written.

REFERENCES

1. Memorandum Report, Project NY-113001-1.01 "Test of Power Elevating System for Outboard Drive of Murray and Tregurtha 02D Propulsion Unit" by W. B. Mitchell and A. L. Scott, dated 16 January 1956.

Figure 1. One-piece gear carrier (arrow) with new ring gears and pinion.

Figure 2. Operator's control station.
1 - Hydraulic guage 2 - Elevation control lever 3 - Steering control lever